Newhurst Quarry, Leicestershire

[SK 486 180]

Introduction

Newhurst Quarry is located 1 km south-east of Shepshed in Leicestershire (see (Figure 4.6)). The northern part of the site comprises mineralized quarry faces and exposures of diorite. The mineralization includes quartz veins with carbonates (including pink dolomite) and sulphides (namely pyrite), which are both abundant. An unconformity between the Charnian Supergroup (Neoproterozoic III) and Triassic rocks is particularly well-exposed in the deep palaeowadi at the western end of the quarry. Rich copper mineralization can be found here; this takes the form of native copper with malachite and rare azurite (King and Ford, 1968). The copper mineralization commonly appears to be associated with dolomite and rhombic calcite. Newhurst Quarry is of particular geological significance as the first know occurrence of the vanadium mineral vesignieite, $Cu_3Ba(VO_4)_2(OH)_2$. More recently, Ince (2005) has provided an extensive review of the mineralogy of Newhurst Quarry and described the presence of additional vanadate minerals, including mottramite and vanadinite, as well as the molydate mineral wulfenite. Ince (2005) also discredited the account of coulsonite from Newhurst Quarry.

Description

Mineralization in Newhurst Quarry (see (Figure 4.7)) tends to occur on the unconformity surface between the (Neoproterozoic III) Charnian Supergroup and the overlying Triassic mudstones, and within the basal beds of the Triassic sedimentary rocks up to 0.6 m from the unconformity surface, particularly in the breccias. Mineralization is characterized by copper carbonates, namely malachite and azurite. Copper sulphides are also present and occur at this locality predominantly as chalcocite veinlets within the Charnian joint-system, immediately below the unconformity. The veinlets are commonly surrounded by oxidation products and associated with goethite.

Occasionally the chalcocite occurs as earthy deposits within geodes of dolomite crystals that are present in the basal beds of the Triassic sandstones (Sylvester-Bradley and Ford, 1968). This form of mineral development is well displayed at Newhurst Quarry, although nodular chalcocite can also be observed at the nearby western (No. 2) quarry of Redland Roadstone Ltd at Groby. The nodules are frequently surrounded by oxidation products and similarly associated with dolomite, calcite and goethite (Sylvester-Bradley and Ford, 1968). Other types of copper mineralization associated with the unconformity in the region and that can be observed at Newhurst Quarry, take the form of native copper, together with cuprite, azurite, and malachite. These occur as nodular masses within the basal beds of the Triassic sandstones and may be up to 20 cm in diameter, weighing up to 1 kg. Native copper commonly takes a thin, sheet-like form which occurs on joint surfaces, and at Newhurst Quarry one occurrence was estimated to measure approximately 10 m by 15 m in area, on a surface immediately below the Triassic unconformity (Sylvester-Bradley and Ford, 1968).

Towards the north-eastern face of Newhurst Quarry a number of hypogene copper-rich quartz-carbonate veins have been exposed. These are confined to one of the three large NW-trending shear zones that are associated with late movements in the Long Cliff Reversed Fault System (Watts, 1947). The veins cut intrusive granophyric diorite (Snowball, 1952) and fine-grained hornfelsed volcanic tuffs of the Blackbrook Group, which is part of the Charnian Supergroup (Watts, 1947).

Primary copper minerals in the veins consist of an intimate association of bornite, chalcocite and chalcopyrite. Mineralogical zonation within individual veins is also apparent in the form of an upper bornite-chalcocite zone, giving way to a chalcopyrite zone below, with a lower zone of galena at the base, and with quartz and ferroan dolomite as gangue (King and Wilson, 1976). The upper portions of these veins (the bornite-chalcocite association) show evidence of extensive supergene alteration, and a boxwork structure of oxidized copper salts and goethite with relic sulphides is commonly all that remains of the original bornite-chalcocite association.

In the cavities of the oxidized bornite-chalcocite veins, tiny rosettes (up to 2.4 mm in diameter) of thin tabular crystals in sub-parallel orientation, yellowish-green in colour, of vesignieite ($Cu_3Ba(VO_4)_2(OH)_2$) are found dispersed on the corroded surfaces. Maximum crystal plate width observed was 2.1 mm, and the crystal thicknesses were up to 0.4 mm (King and Wilson, 1976). Ince (2005) described an extensive supergene mineral assemblage occurring in vertically orientated oxidized sphalerite-chalcopyrite-galena veins located 5–10 m below the Neoproterozoic–Triassic unconformity, containing the vanadate minerals mottramite and vanadinite, and the molybdate mineral wulfenite.

Interpretation

The exceptional mineralization in the Charnwood Forest area may be a result of limited chemical activity associated with the Charnian Supergroup (Neoproterozoic)–Triassic unconformity (Sylvester-Bradley and Ford, 1968). The Charnwood Forest rocks appear to have been less susceptible to chemical reaction with percolating mineral solutions than the Carboniferous strata that underlies the mineralized Permo-Triassic unconformity in the Nuneaton area, which is also associated with copper mineralization (Sylvester-Bradley and Ford, 1968). This is because mineralizing fluids descending below the unconformity into the Charnian sequence appear to have been restricted to vein-like bodies which occupy joint planes, and no major wall-rock alteration has occurred.

The supergene alteration/modification may have occurred during late Triassic times, as the veins have been planed off below a visible thickness of 7.2 m of unconformably overlying sandstones and mudstones of the Mercia Mudstone Group (Warrington, 1970). There is also evidence of recycling and reprecipitation of copper salts at the unconformity and below it in the form of mineralized pipe-like bodies, within the underlying igneous and metavolcanic rocks, filled with Charnian and Triassic debris (King and Wilson, 1976).

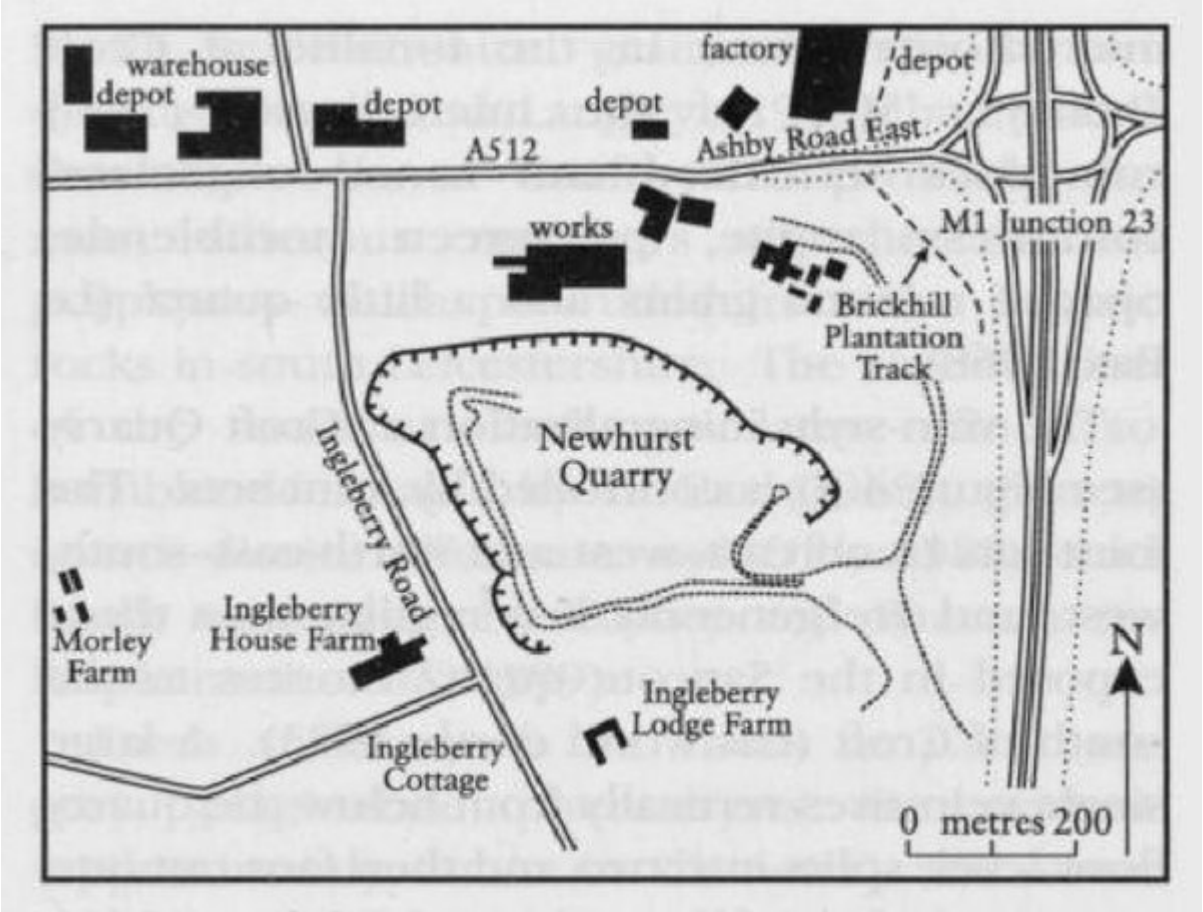
King and Wilson (1976) suggested that the overlying sedimentary rocks of the Tarporley Siltstone Formation of the Mercia Mudstone Group are the likely source of both barium and vanadium; barite is present as cement in certain sandstone units, while dispersions of wad (manganese oxides/hydroxides) carrying traces of vanadium frequently coat the upper surfaces of mudstone units in the same formation. High concentrations of wad also occur below the unconformity in the pipe-like bodies.

A similar vanadium-rich cuprite deposit is located in Triassic sedimentary rocks at Bardon Hill, 5.5 km to the south-west of Newhurst Quarry (King, 1967).

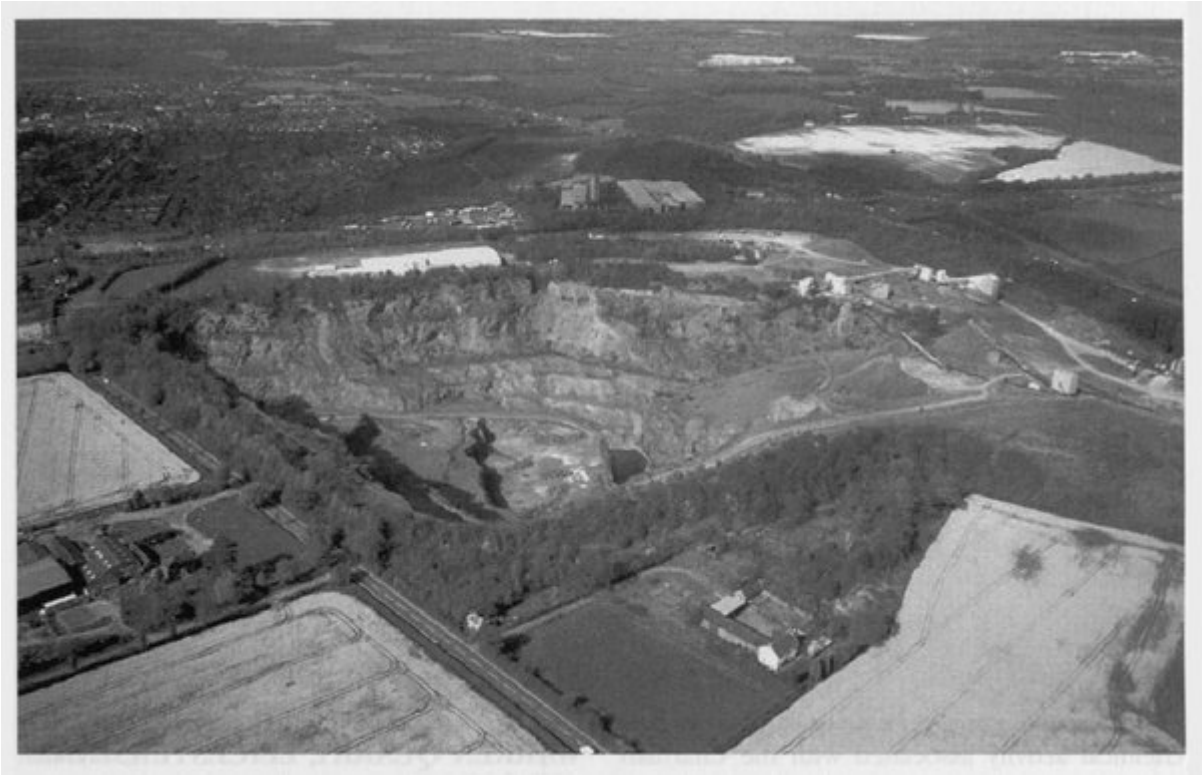
Conclusions

The mineralization at Newhurst Quarry is an excellent example of supergene alteration of copper sulphide minerals, and hosts an assemblage containg the rare vanadate minerals vesignieite, mottramite and vanadinite, and the molybdate mineral wulfenite.

References



(Figure 4.6) Location map of Newhurst Quarry.



(Figure 4.7) The Newhurst Quarry GCR site. (Photo: Midland Quarry Products.)